Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria™ for imaging of the multiply injured patient.

BIBLIOGRAPHIC SOURCE(S)

Daffner RH, Dalinka MK, Alazraki N, Berquist TH, DeSmet AA, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Imaging of the multiply injured patient. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):273-82. [29 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Multiple injuries (severe head or facial injury combined with multiple extremity fractures, blunt abdominal trauma or thoracic trauma)

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Emergency Medicine
Neurological Surgery
Orthopedic Surgery
Radiology
Surgery
Thoracic Surgery

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for the multiply injured patient.

TARGET POPULATION

Patients with multiple injuries, such as severe head or facial injury combined with multiple extremity fractures, blunt abdominal trauma or thoracic trauma.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Plain films
    - Chest x-ray
    - Cervical spine
    - Pelvis x-ray
    - Entire spine x-ray
2. Transesophageal ultrasound
3. Computed tomography
    - Cranial
    - Thoracic
    - Abdominal/pelvic
4. Invasive
    - Angiography
    - Embolization
    - Cystourethrography
5. Cranial magnetic resonance imaging

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Delphi Method)
Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and

weaknesses of each test or procedure are discussed and consensus reached whenever possible.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 1: Patient alert, hemodynamically stable, peritoneal lavage normal or not performed.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Cervical spine	9	High-risk patients. Imaging of rest of vertebral column is dependent on symptoms.
Pelvis x-ray	8	High-risk patients.
Transesophageal ultrasound	1	
Computed Tomography		
Cranial	1	

Thoracic	1	
Abdominal/pelvic	1	
Invasive		
Angiography	1	
Embolization	1	
Cystourethrography	1	Indicated if pelvic disruption is present.
Cranial magnetic resonance imaging	1	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 2: Patient alert, hemodynamically stable, peritoneal lavage abnormal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Cervical spine	9	High-risk patients (if patient does not go to surgery). Imaging of rest of vertebral column is determined by presence of clinical symptoms.
Computed Tomography		
Abdominal/pelvic	9	
Cranial	1	

Thoracic	1	
Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	
Invasive		
Angiography	1	Not indicated unless there is clinical suspicion present.
Embolization	1	
Cystourethrography	1	Indicated if pelvic disruption present.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 3: Patient alert, hemodynamically unstable, peritoneal lavage normal or not performed.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Cervical spine	9	Imaging of rest of vertebral column is dependent on symptoms.
Transesophageal ultrasound	1	
Computed Tomography		
Cranial	1	
Thoracic	1	May be indicated if hematoma is present.
Abdominal/pelvic	1	

Cranial magnetic resonance imaging	1	
Invasive		
Angiography – Invasive	4	Depends on chest x-ray or history.
Embolization	1	May be indicated if bleeding source is determined to be from a pelvic fracture.
Cystourethrography	1	Indicated if pelvic disruption is present.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 4: Patient alert, hemodynamically unstable, peritoneal lavage abnormal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Cervical spine	9	High-risk patients (if patient does not go to surgery). Imaging of rest of vertebral column is determined by presence of clinical symptoms.
Computed Tomography		
Abdominal/Pelvic	9	Important only if patient is not going to surgery.
Cranial computed tomography	1	
Thoracic computed tomography	1	Spiral computed tomography if patient is not going directly to surgery.

Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	
Invasive		
Angiography	1	Not indicated unless clinical suspicion is present.
Embolization	1	May be indicated if angiography demonstrates a source of hemorrhage.
Cystourethrography	1	Indicated if pelvic disruption is suspected.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 5: Patient obtunded, hemodynamically stable, peritoneal lavage normal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Entire spine x-ray	9	
Computed Tomography		
Cranial	9	
Thoracic	1	
Abdominal/pelvic	1	Probably indicated, if lavage was not performed or was unsuccessful.
Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	

Invasive		
Angiography	1	
Embolization	1	
Cystourethrography	1	Indicated if pelvic disruption is suspected.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Variant 6: Patient obtunded, hemodynamically unstable, peritoneal lavage normal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Entire spine x-ray	9	
Computed Tomography		
Cranial computed tomography	9	
Abdominal/pelvic	6	To look for intracapsular injuries missed by diagnostic peritoneal lavage.
Thoracic computed tomography	1	If chest x-ray showed normal findings.
Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	
Invasive		
Angiography	1	For thoracic aortic injury.
Embolization	1	May be indicated if source of

		hemorrhage is identified.
Cystourethrography	1	Indicated if pelvic disruption present.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiply Injured Patient, Initial Imaging Evaluation

Variant 7: Patient obtunded, hemodynamically stable, peritoneal lavage abnormal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Entire spine x-ray	9	
Computed Tomography		
Cranial	9	
Abdominal/pelvic	9	
Thoracic computed tomography	1	Assuming chest x-ray normal.
Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	
Invasive		
Angiography	1	May be indicated to identify source of suspected bleeding.
Embolization	1	May be indicated if source of bleeding is identified.
Cystourethrography	1	Indicated if pelvic disruption is present.

Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate

Variant 8: Patient obtunded, hemodynamically unstable, peritoneal lavage abnormal.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Chest x-ray	9	
Pelvis x-ray	9	
Entire spine x-ray	9	High-risk patients (patient usually goes to surgery).
Computed Tomography		
Cranial	9	May be delayed if patient is going directly to surgery.
Abdominal/pelvic	9	Only if patient is not going directly to surgery.
Thoracic	1	Spiral scan may be done if patient does not go directly to surgery.
Transesophageal ultrasound	1	
Cranial magnetic resonance imaging	1	
Invasive		
Angiography	1	May be necessary if source of bleeding is not found at surgery.
Embolization	1	May be necessary if source of bleeding is not found at surgery.
Cystourethrography	1	May be necessary if source of bleeding is not found at surgery.
Appropriateness Criteria Scale		

1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate

Excerpted by the National Guideline Clearinghouse (NGC).

Results

This review involved the choice of initial imaging to be performed on patients suffering multiple trauma. All of the imaging studies listed have been used by various clinical groups. Overall, there was consensus by the group on the indications for the following imaging studies to be performed on patients suffering multiple trauma:

1. Chest radiographs: All patients.
2. Pelvic radiographs: All patients.
3. Vertebral radiographs: Indicated on all obtunded patients. Should also be performed on all patients who fit into the "high risk" group as defined by Vandemark (such as high-velocity blunt trauma, multiple fractures, altered mental status, fall of more than 10 feet, and significant head injury). Must be delayed if the patient requires immediate surgery.
4. Extremity radiographs: Should be determined by clinical exam. Extremity trauma generally takes a "back seat" to life-threatening injuries.
5. Transesophageal ultrasound: Performed almost exclusively by surgeons. Has its drawbacks. Should be replaced by spiral computed tomography.
6. Cranial computed tomography: Necessary in patients who are obtunded. Exact timing of when this exam is performed will be dictated by the need for immediate surgical intervention.
7. Thoracic/mediastinal computed tomography: Indicated for all cases of suspected mediastinal hemorrhage and mediastinal widening in an otherwise stable patient. If the patient is unstable, angiography is the "gold standard".
8. Abdominal/pelvic computed tomography: Indicated in patients with normal diagnostic peritoneal lavage who are unstable. Has high reliability. Patients with an abnormal diagnostic peritoneal lavage and who are unstable will generally go directly to the operating room. If they are stable, the surgeons may want a more definitive look at the abdomen. Helical computed tomography will shorten examination time.
9. Cranial magnetic resonance imaging: Not indicated.
10. Angiography: Group consensus was that it was not indicated in most instances unless there are good clinical grounds. The "gold standard" for the diagnosis of thoracic aortic injury. May be useful in the patient with pelvic bleeding that cannot be controlled by external fixation. Surgical literature indicates it is indicated for patients with blunt chest trauma and fractures of the first rib(s) owing to a high (24%) incidence of vascular injuries in those patients.
11. Embolization: General consensus was that it is not necessary. Has been shown to be effective in pelvic bleeding not controlled by other means.
12. Cystourethrography: Consensus was that it is not indicated routinely. Virtually all patients with multiple trauma have microscopic or occasionally gross blood in the bladder upon catheterization. The yield is small. In most cases, nothing

more than a pelvic hematoma associated with a pelvic fracture is demonstrated.

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate selection of radiologic exam procedures to evaluate the multiply injured patient.

Subgroups Most Likely to Benefit:

Patients with the most likely lethal injuries, including exsanguination, cardiopulmonary compromise, and intracranial abnormalities.

POTENTIAL HARMS

None identified

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the

appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Daffner RH, Dalinka MK, Alazraki N, Berquist TH, DeSmet AA, el-Khoury GY, Goergen TG, Keats TE, Manaster BJ, Newberg A, Pavlov H, Haralson RH, McCabe JB, Sartoris D. Imaging of the multiply injured patient. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):273-82. [29 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1995 (revised 1999)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™.

GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Musculoskeletal Imaging.

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Richard H. Daffner, MD; Murray K. Dalinka, MD; Naomi Alazraki, MD; Thomas H. Berquist, MD; Arthur A. DeSmet, MD; George Y. El-Khoury, MD; Thomas G. Goergen, MD; Theodore E. Keats, MD; B.J. Manaster, MD, PhD; Arthur Newberg, MD; Helene Pavlov, MD; Robert H. Haralson, III, MD; John B. McCabe, MD; David Sartoris, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline. It is a revision of a previously issued version (Appropriateness criteria for imaging of the multiply injured patient. Reston [VA]: American College of Radiology (ACR); 1995. 10 p. [ACR Appropriateness Criteria™]).

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2004.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001.

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